

CLAIMS

What is claimed is:

1. A time division multiple access (TDMA) based network backbone comprising:

a plurality of nodes including a plurality of receive antennas for receiving a plurality of radio frequency (RF) bursts and a plurality of transmit antennas for transmitting said RF bursts;

a node control for communicating information relating to said nodes;

a timing reference subsystem for providing timing signals to said nodes;

said receive antennas operated in accordance with a plurality of receiving slots and said transmit antennas operated in accordance with a plurality of transmitting slots; and

a plurality of links interconnecting said nodes.

2. The network backbone of claim 1, wherein said timing reference subsystem comprises a global positioning system.

3. The network backbone of claim 1, wherein transmitting times for said RF bursts are aligned to boundaries of said transmitting slots.

4. The network backbone of claim 1, wherein receiving times for said RF bursts are aligned to boundaries of said receiving slots.

5. The network backbone of claim 1, wherein a plurality of said nodes transmit simultaneously.

6. The network backbone of claim 1, wherein a duration of said RF bursts is shorter than a time of flight (TOF) between said nodes.

7. The network backbone of claim 1, wherein each of said nodes further comprising:

a clock for providing backup timing signals.

8. A method of forming a TDMA based network backbone, comprising:

sending an orderwire message from a first node selected from a plurality of nodes to other nodes of said plurality of nodes, said first node using a node control for sending said orderwire message to said other nodes;

selecting a second node to form a link, said second node having a plurality of second transmit slots and a plurality of second receive slots;

calculating time-of-flight of a transmission from said first node to said second node using locations of said first node and said second node;

sending an orderwire message from said first node to said second node offering a plurality of first transmit slots and a plurality of first receive slots to said second node; and

sending a status message from said second node to said first node.

9. The method of claim 8, further comprising the steps of:

forming an acceptable receive list after comparing said first transmit slots with said second receive slots; and

forming an acceptable transmit list after comparing said first receive slots with said second transmit slots.

10. The method of claim 9, wherein:

said status message comprises an acceptance message if said acceptable receive list and said acceptable transmit list are not empty, said acceptance message including said acceptable receive list and said acceptable transmit list.

11. The method of claim 9, wherein:

said status message comprises a rejection message if said acceptable receive list is empty.

12. The method of claim 9, wherein:

said status message comprises a rejection message if said acceptable transmit list is empty.

13. The method of claim 9, further comprising the step of:

applying a user defined rule to said acceptable receive list and said acceptable transmit list.

14. A method for communicating over a TDMA based network backbone, comprising:

determining a location for each one of a plurality of nodes, a plurality of each of said nodes including a node control for determining node location;

calculating a time-of-flight between a sending node of said plurality of nodes, and a sub plurality of receiving nodes of said plurality of nodes;

transmitting a plurality of RF bursts from said sending node to said receiving nodes using a plurality of transmitting phased array antennas (PAAs), said transmitting PAAs operating in accordance with a plurality of transmitting slots; and

receiving a plurality of RF bursts from said sending node, using a plurality of receive phased array antennas (PAAs), said receive PAAs operating in accordance with a plurality of receiving slots.

15. The method of claim 14, wherein said step of receiving is performed at times so as to be aligned with said receiving slots.

16. The method of claim 14, wherein said step of receiving is performed at times so as to be aligned with said transmitting slots.

17. The method of claim 14, further comprising the step of:
spacing the RF bursts to avoid overlapping one another.

18. The method of claim 14, wherein said step of transmitting, further comprising:

managing transmission times so that a single said transmitting PAA is restricted from attempting to simultaneously transmit to any two of said nodes.

19. A method for dynamically adjusting link capacities for a time division multiple access (TDMA) network backbone, comprising:

estimating a needed modification in a total plurality of TDMA slots of a given transmission link for adjusting a link capacity of said given transmission link to accommodate a desired transmission link capacity;

sending a modification request from a first node of said given transmission link to a second node of said given transmission link;

updating a current status of said second node to accommodate a desired transmission link capacity; and

sending a status message from said second node to said first node.

20. The method of claim 19 wherein said step of updating a current status, comprising:

constructing a send times block by said first node for determining starting times for transmissions from said first node to said second node;

updating a physically acceptable transmit list for additional required TDMA slots on said first node;

sending a request to said second node for additional transmit capacity along with updated said physically acceptable transmit list;

constructing a physically acceptable receive list from a comparison of a plurality of available receive TDMA slots on said second node with said physically acceptable transmit list;

truncating said acceptable receive list to match said request for additional transmit capacity;

sending said acceptable receive list to said first node; and

using additional capacity if said acceptable receive list contains at least one additional slot.

21. The method of claim 19 wherein said step of updating a current status, comprising:

using said first node to estimate a plurality of transmit TDMA slots and a plurality of receive TDMA slots to be removed to reduce link capacity;

selecting said transmit TDMA slots and said receive TDMA slots to be removed by said first node based on a user-defined criteria;

sending to said second node a request for removing certain of said transmit TDMA slots and certain of said receive TDMA slots;

causing said second node to remove said certain TDMA transmit slots and said certain TDMA receive slots by said second node;

sending an acknowledgement of removal of said certain TDMA transmit and TDMA receive slots from said second node to said first node; and

ceasing the use of said certain TDMA transmit slots and said certain TDMA receive slots by said first node and said second node.

22. A method for maintaining a communication link between two nodes in the event of a change in a location of at least one of said two nodes, comprising:

tracking, by a first node, a change in an angular position and an angular rate of movement of each of a plurality of links relative to a field-of-regard of a first antenna of said first node, said first node selected from a plurality of nodes;

predicting a cross-over by each of said links confined within said field-of-regard of said first antenna into said field-of-regard of a second antenna associated with said first node;

estimating a time of occurrence of said cross-over;

communicating by said first node a first list of a plurality of available slots associated with said second antenna and an estimated time of said cross-over to a second node selected from said nodes;

identifying, by said second node, a plurality of acceptable slots from said first list offered by said first node to create a second list;

communicating, by said second node, said second list of said acceptable slots to said first node; and

operating said link between said first node and said second node using said acceptable slots from said second list beginning at said estimated time of said cross-over.

23. The method of claim 22 wherein said first antenna comprises a phased array antenna.

24. A method for managing a communication system to predict and prevent collision of a plurality of RF bursts transmitted by a first antenna over a plurality of links associated with said first antenna on a first node, the method comprising:

tracking, by said first node, the likelihood of an overlap in said RF bursts transmitted by said first antenna over said links to a second node and a third node, said first node, said second node and said third node selected from a plurality of nodes, said first antenna selected from a plurality of transmission antennas on said first node;

estimating, by said first node, the relative motion of said second node and said third node;

predicting, by said first node, the time of occurrence of said overlap between said RF bursts transmitted from said first node to said second node and to said third node; and

reassigning a transmission of said RF bursts from said first node to said third node for avoiding said overlap.

25. The method of claim 24 wherein said step of reassigning comprises:

identifying a plurality of transmission slots available on said first node at the time of occurrence of said overlap, said transmission slots being associated with said first antenna, said transmission slots being intervals for transmission of said RF, said transmission slots including a selection of said transmission slots becoming available upon resolving of said overlap;

creating a first list comprised of said plurality of transmission slots available on said first node;

creating a second list of said transmission slots to be eliminated for avoiding said overlap;

communicating from said first node to said third node said first list, said second list, and a point of time for elimination of said slots in said second list;

identifying, by said third node, acceptable said transmission slots from said first list of said transmission slots communicated by said first node for creating a third list;

communicating, by said third node, said third list of said slots to said first node;

ceasing by said first node and said third node the use of said transmission slots listed in said second list at said point in time; and

operating said link between said first node and said third node using said slots from said third list beginning at said point in time.